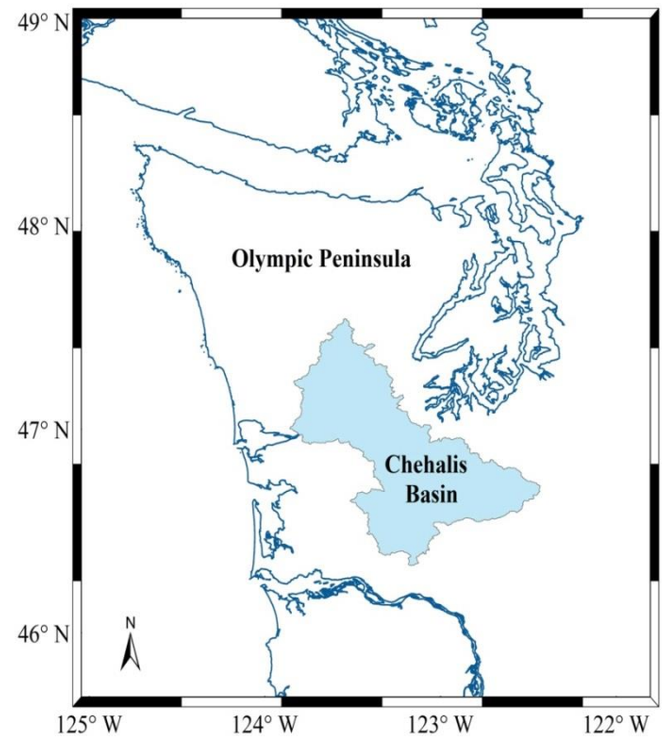
Evaluation of satellite precipitation products for hydrologic predictions in topographically complex regions: the Chehalis River Basin as a case study

Diana R. Gergel[1], Qian Cao[2], Joseph J. Hamman[1], Elizabeth A. Clark[1], Dennis P. Lettenmaier[2], Bart Nijssen[1]

1. Dept of Civil and Environmental Engineering, University of Washington, Seattle, WA
2. Dept of Geography, University of California at Los Angeles

Background



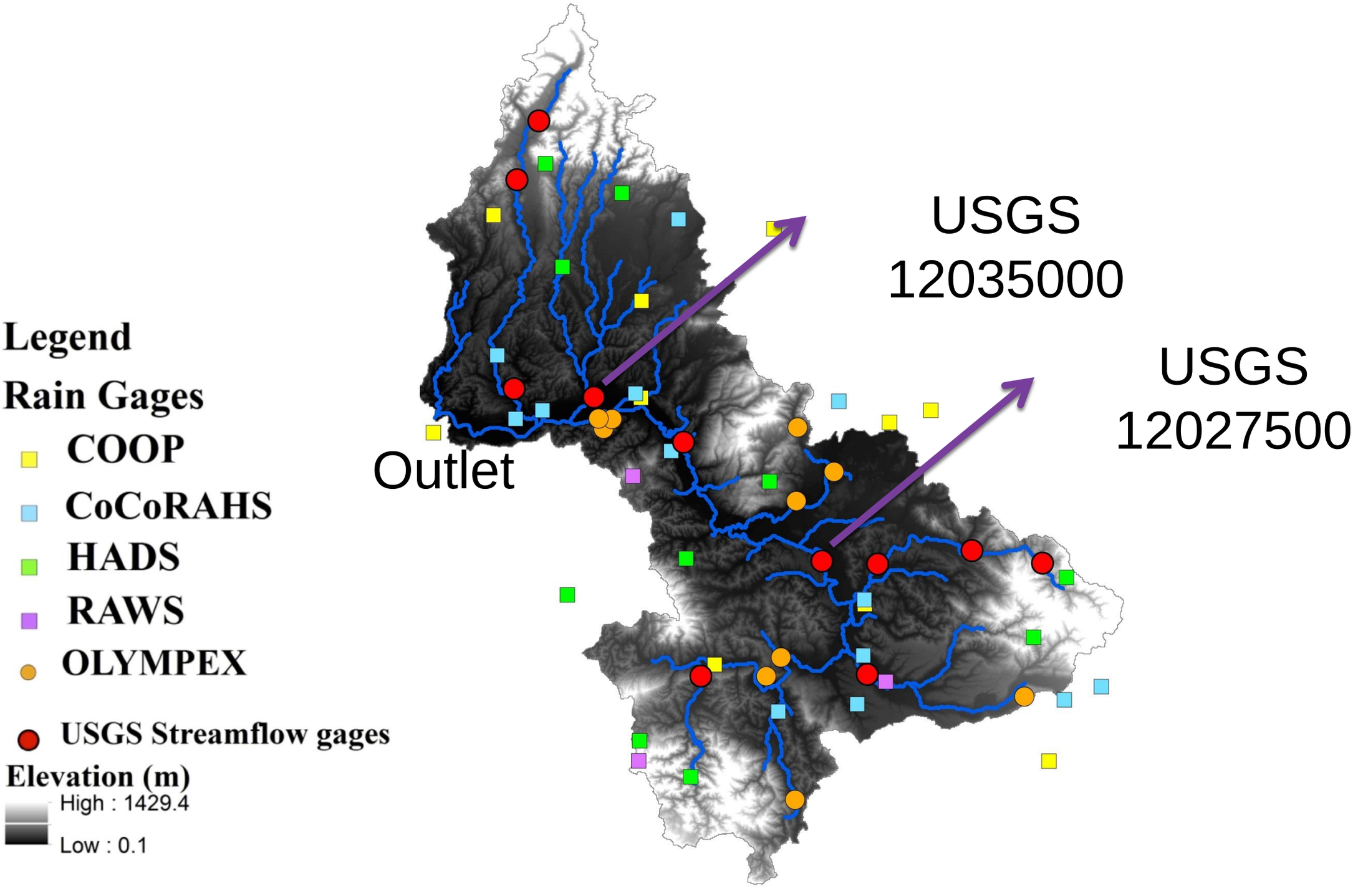
- coastal watershed
  - minimally affected by snow during most precipitation events (rain-dominant) except for highest elevations (transient areas)
  - drains directly to the Pacific
- history of intensive flooding in Chehalis Basin: 2007 flood that closed down I-5
- primarily privately owned land (Weyerhaeuser)

Field Study

Timeline of Study

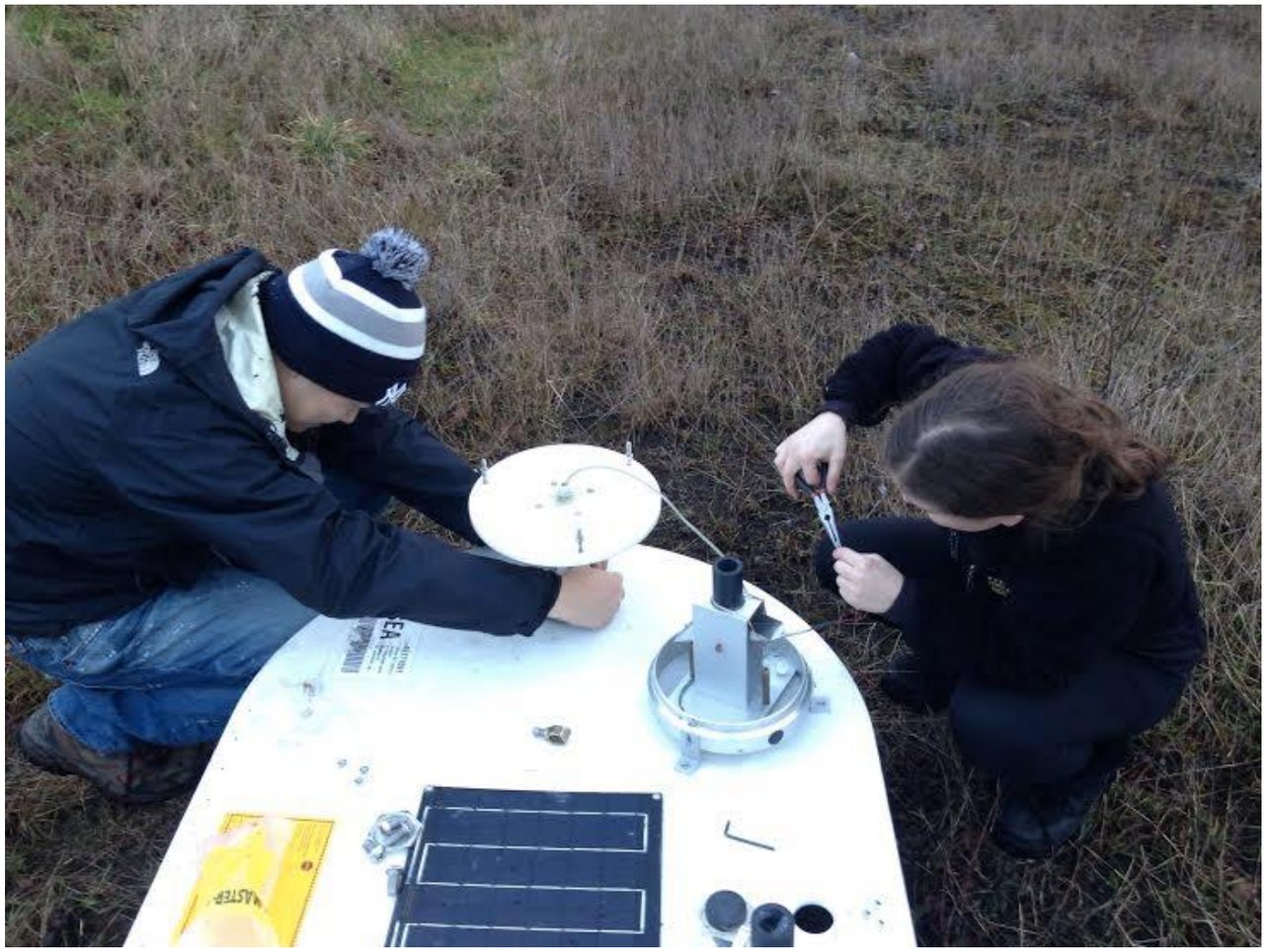
- 2014-2015: pilot year of field study: installation of 5-10 rain gauges (dual-platform gauges); CoCoRaHS recruitment
- 2015-2016: network of 10 dual-platform rain gauges along with over 50 other gauges

Map of rain and USGS gauges



Dual Platform Gauge

CoCoRaHS gauge



Update from the field: The flooding down here is really intense. The Chehalis extends for miles beyond the riverbanks. Rain is coming down pretty hard too and it's super windy, so I'm waiting it out a bit before swapping the batteries.

Modeling Work

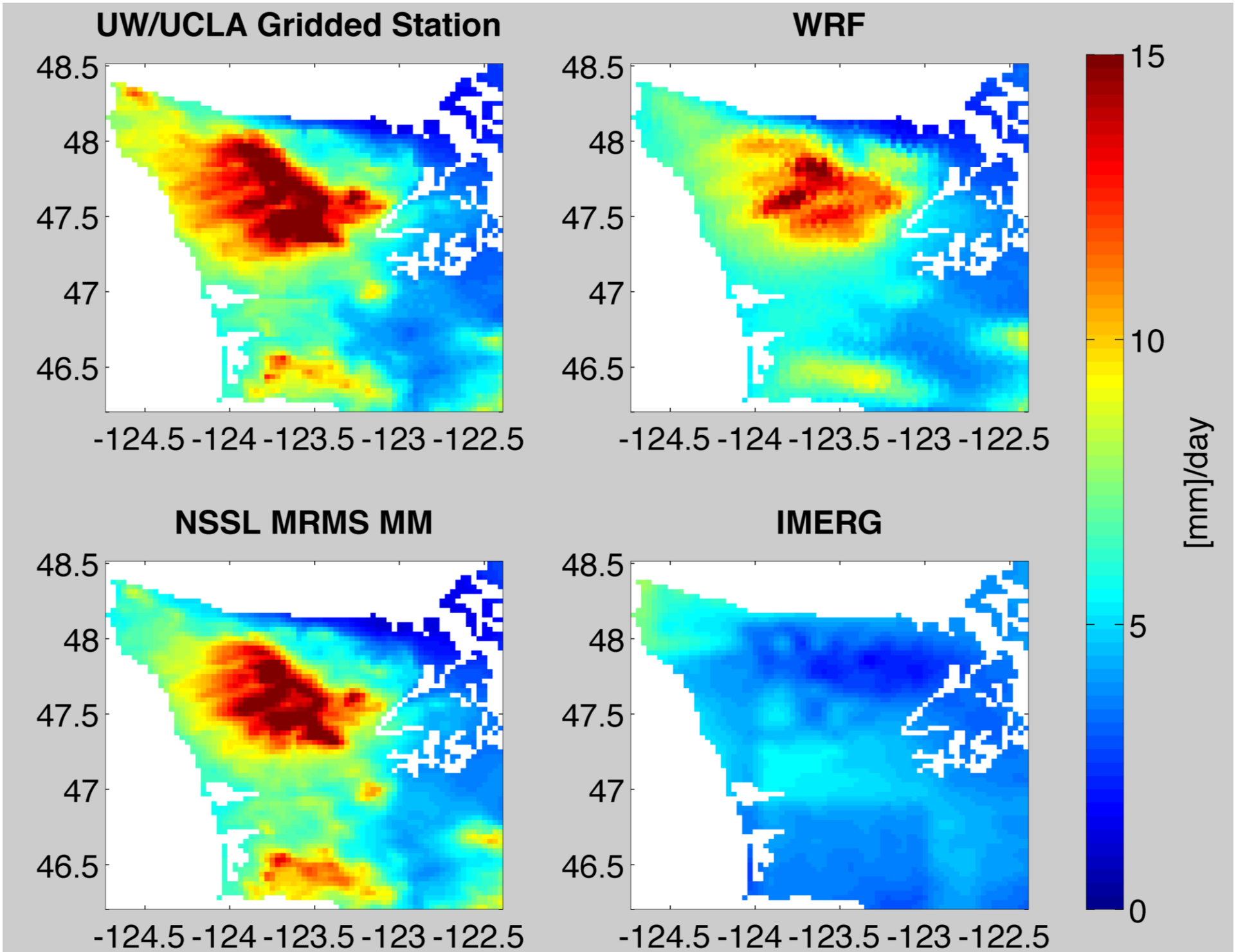
Comparison of precipitation products over Olympic Peninsula

Data Sets	Resolution	Start Date	End Date
UW/UCLA Gridded Station	1/32 degree	1/1/1920	Current
UW WRF (Model forecast)	4 km	1/1/2009	Current
NSSL MRMS MM (Radar)	1 km	10/1/2014	Current
IMERG (Satellite)	0.1 degree	3/12/2014	Current

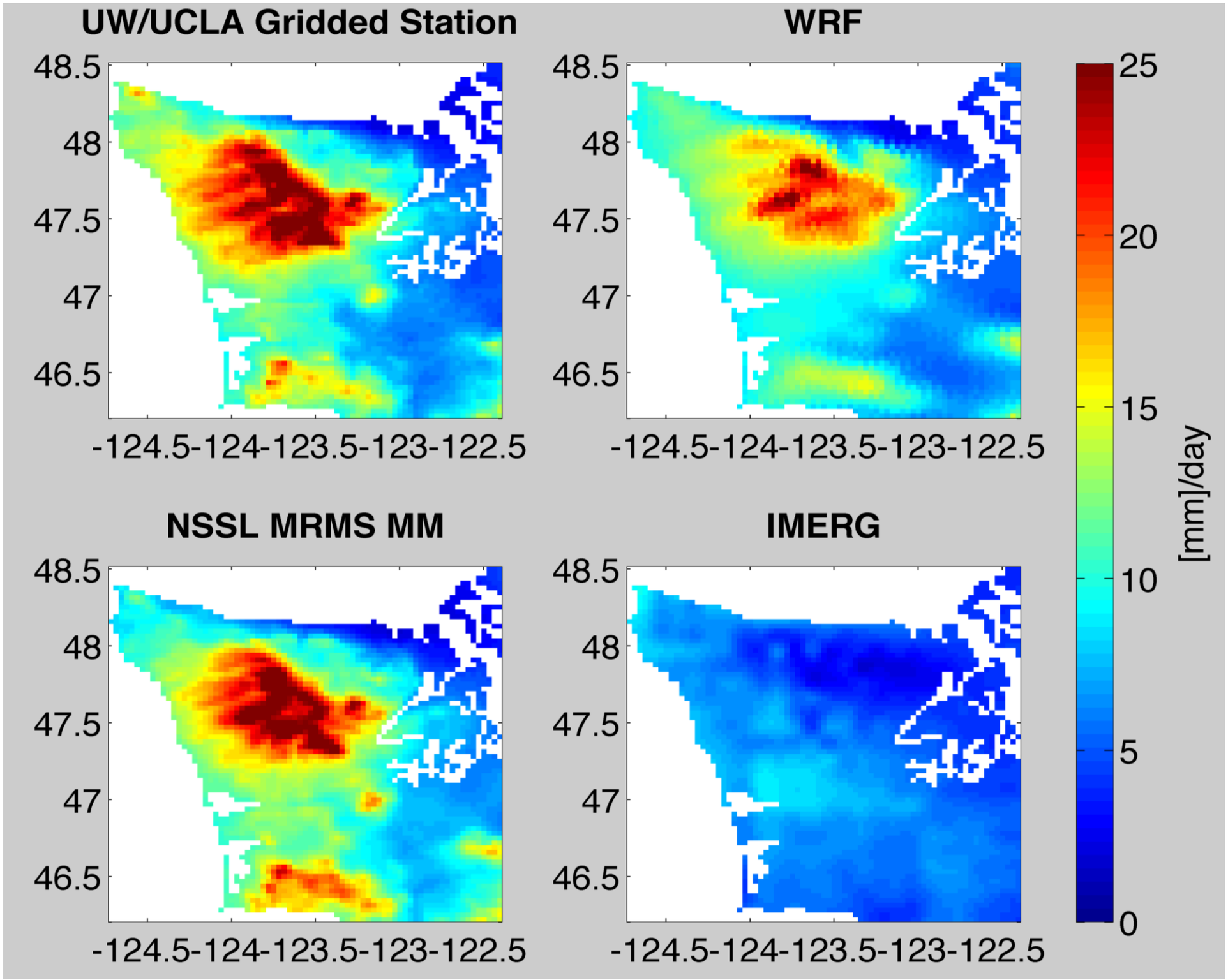
- NSSL MRMS MM

The National Severe Storms Laboratory (NSSL) Multi-Radar Multi-Sensor System (MRMS) Mountain Mapper (MM)

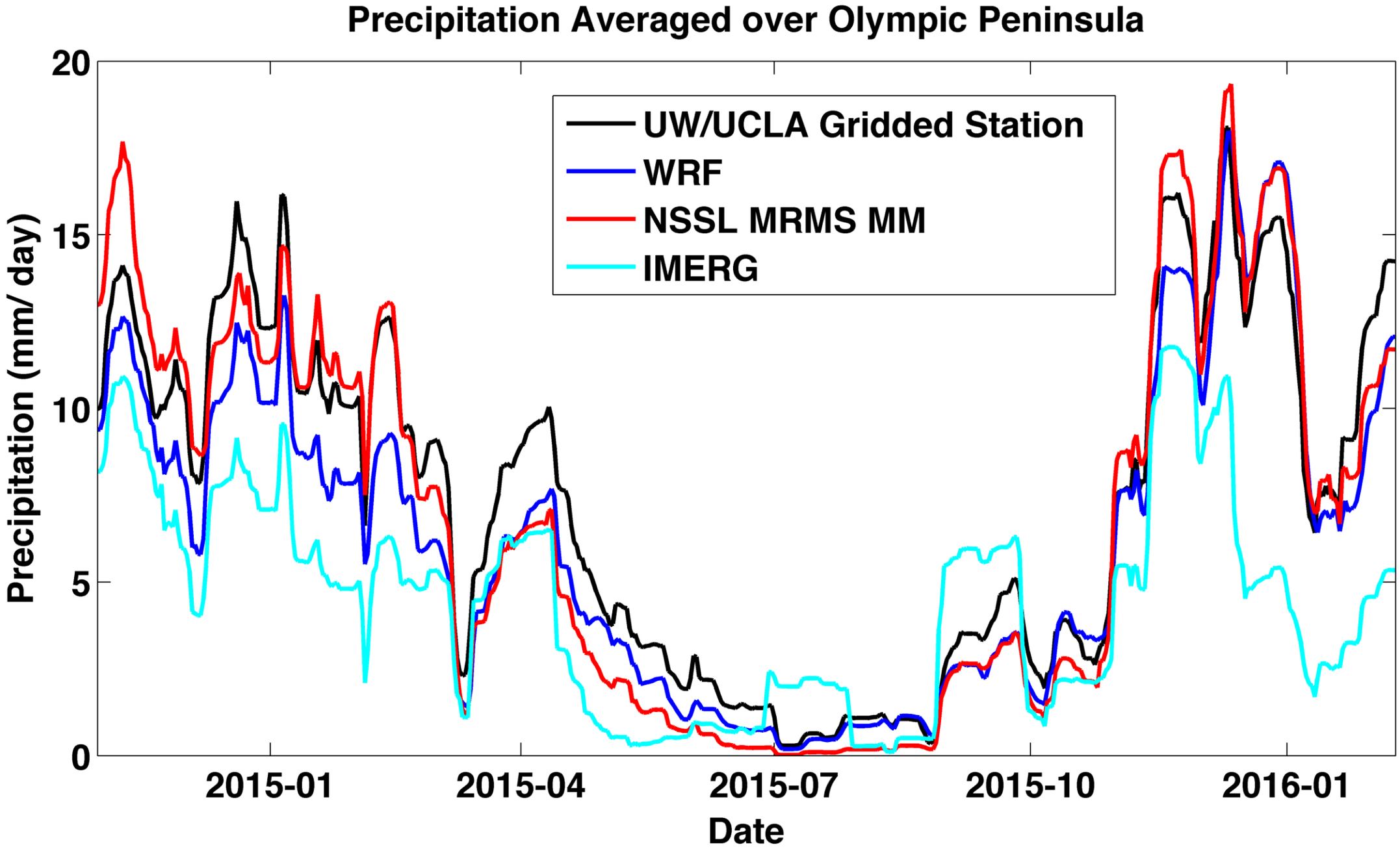
Average Daily Precipitation Comparison Over Olympic Peninsula (2014/10/1~2016/2/9)



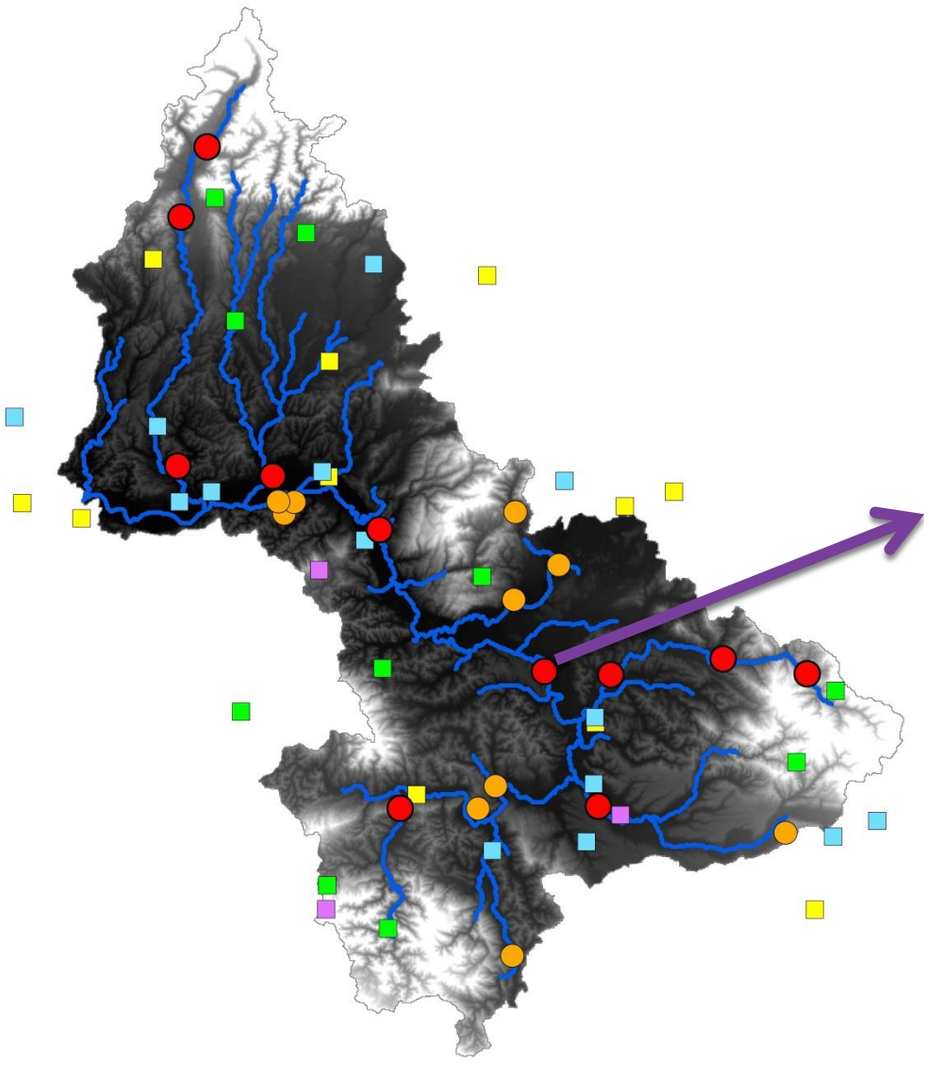
Winter (Nov~Jan) Average Daily Precipitation Comparison (2014~2016)

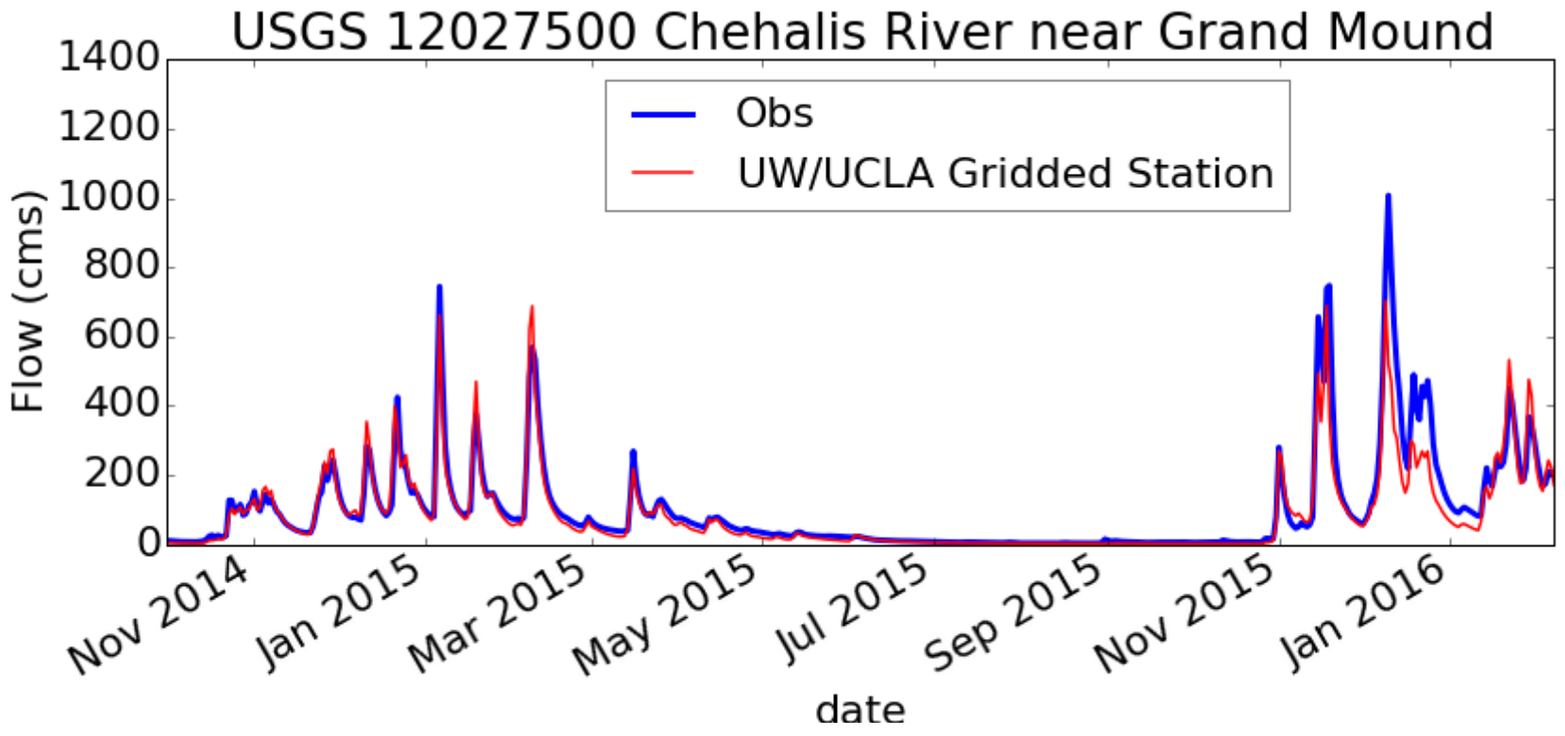


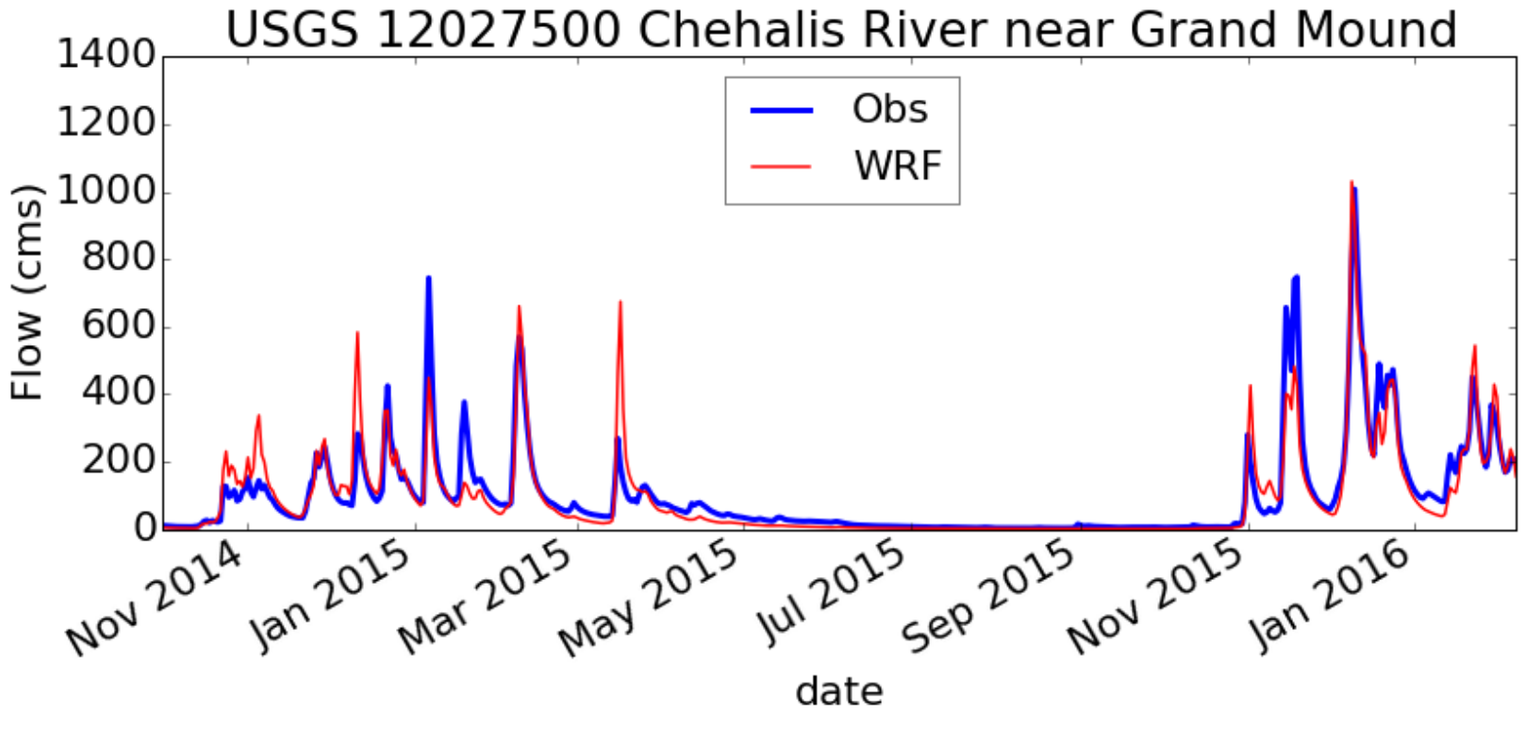
30 Days Moving Average Comparison (2014/10/1~2016/2/9)



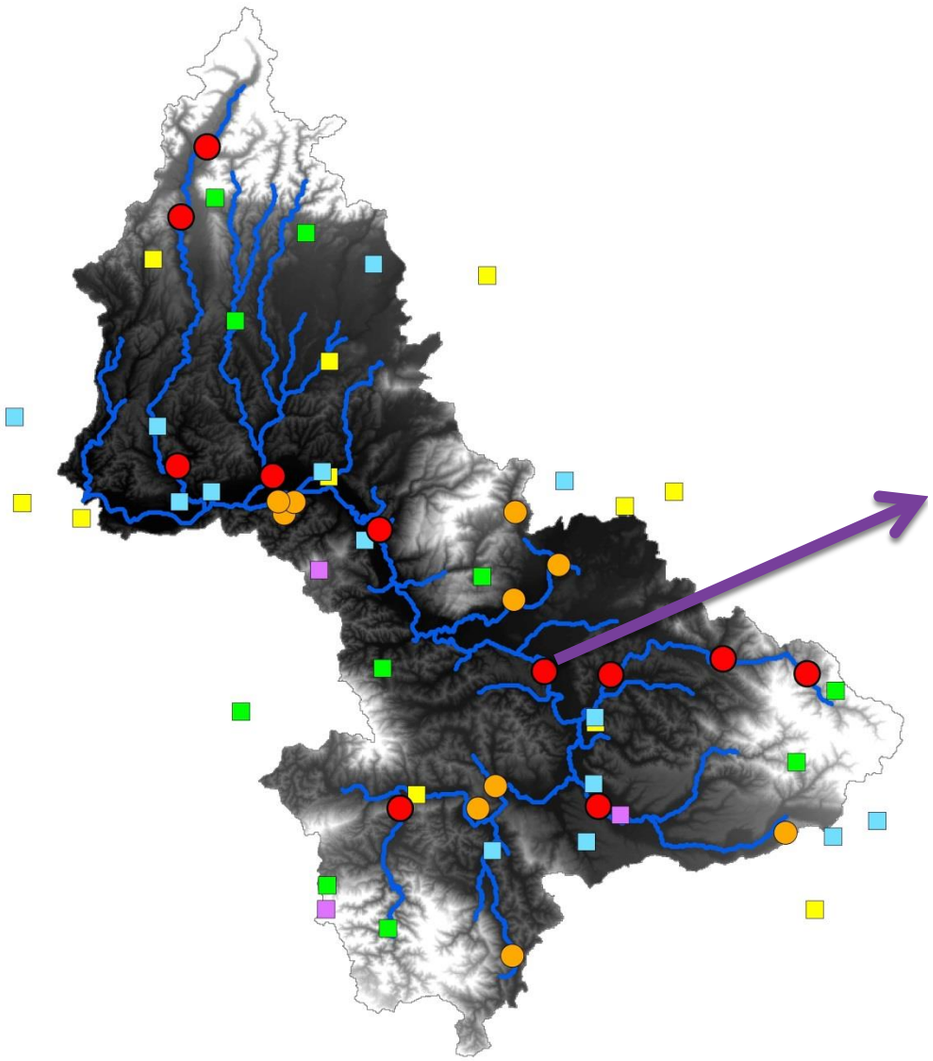
Daily Streamflow Simulation
UW/UCLA Gridded Station & WRF

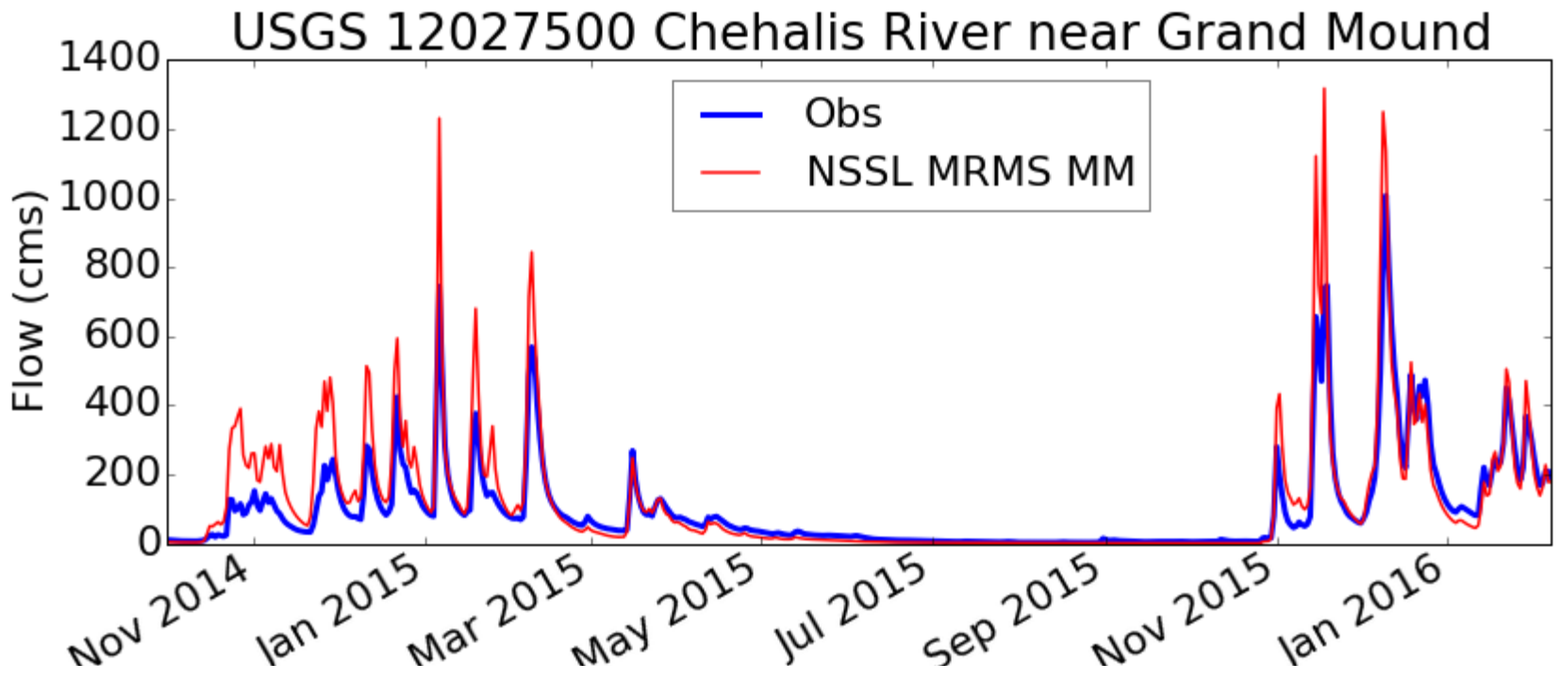


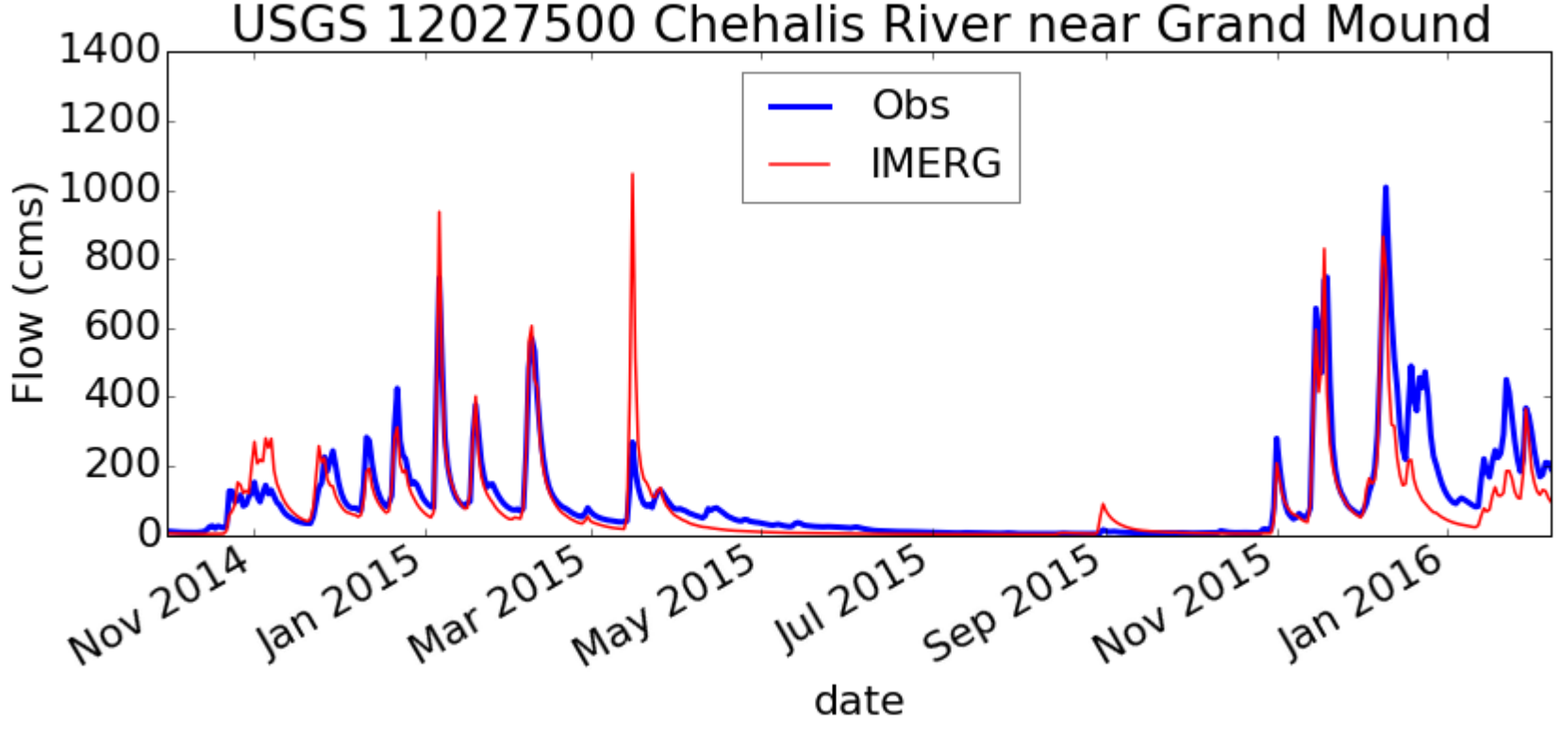




Daily Streamflow Simulation
MRMS & IMERG







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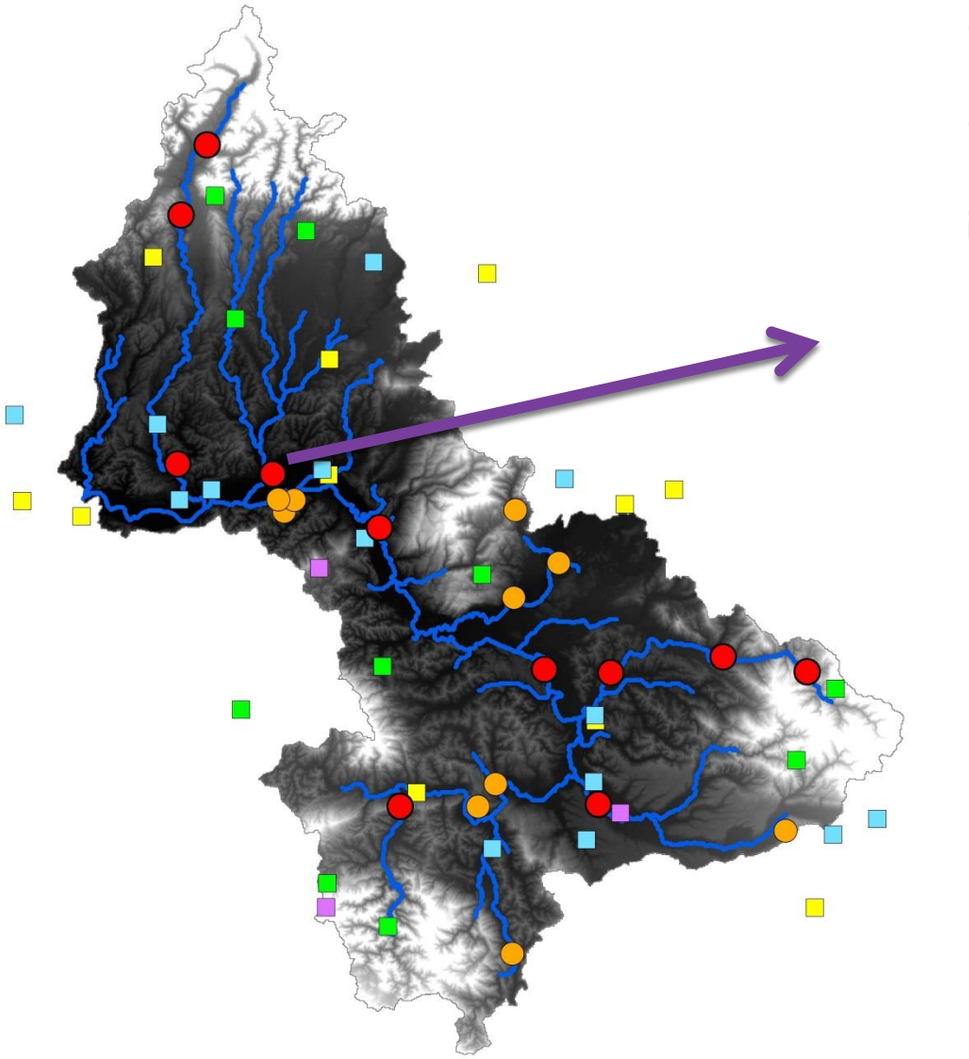

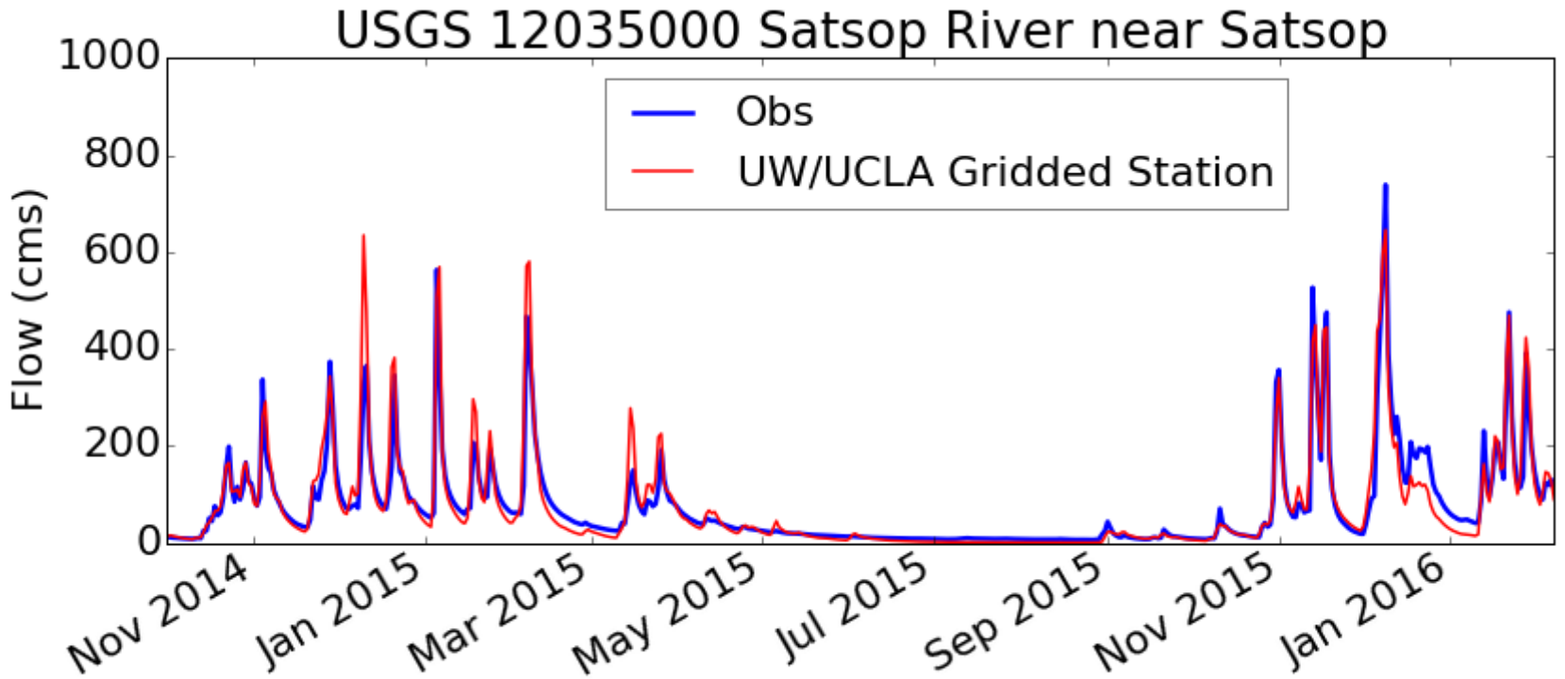

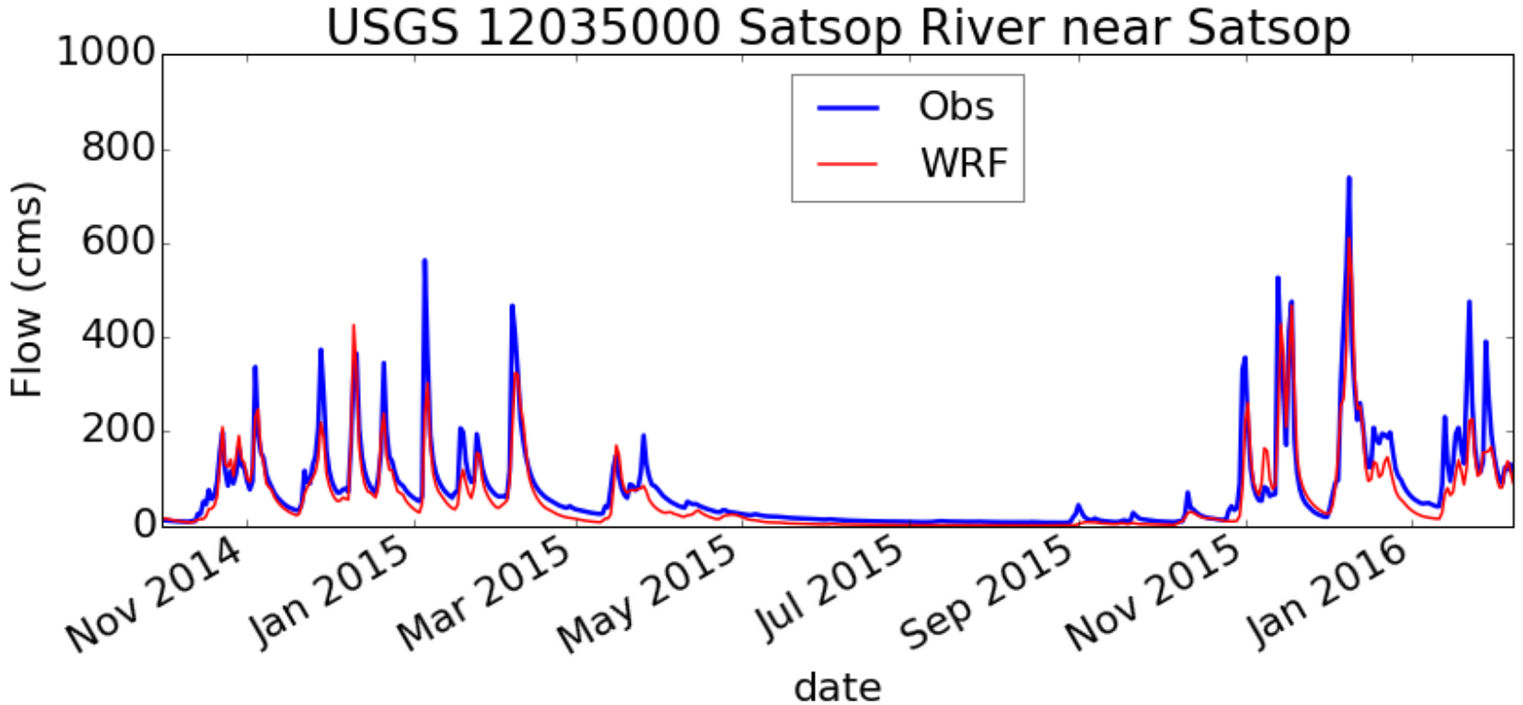

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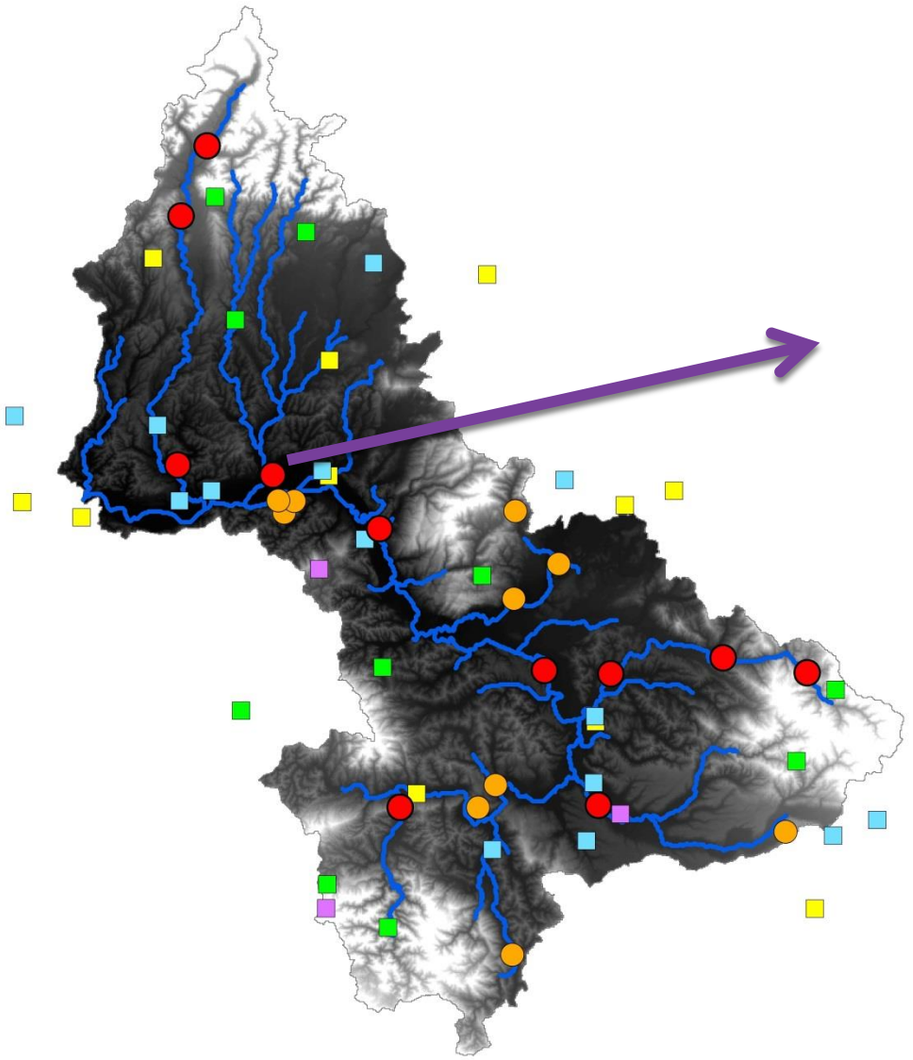

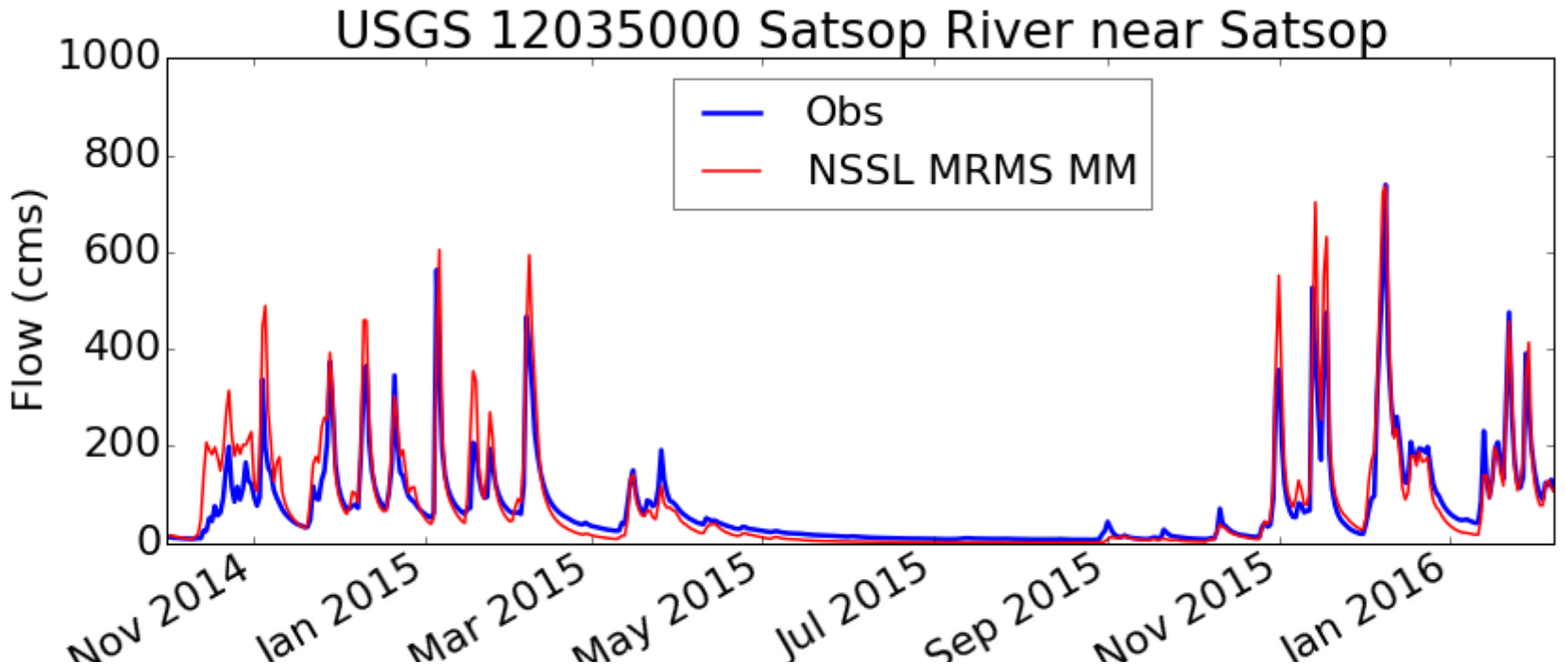

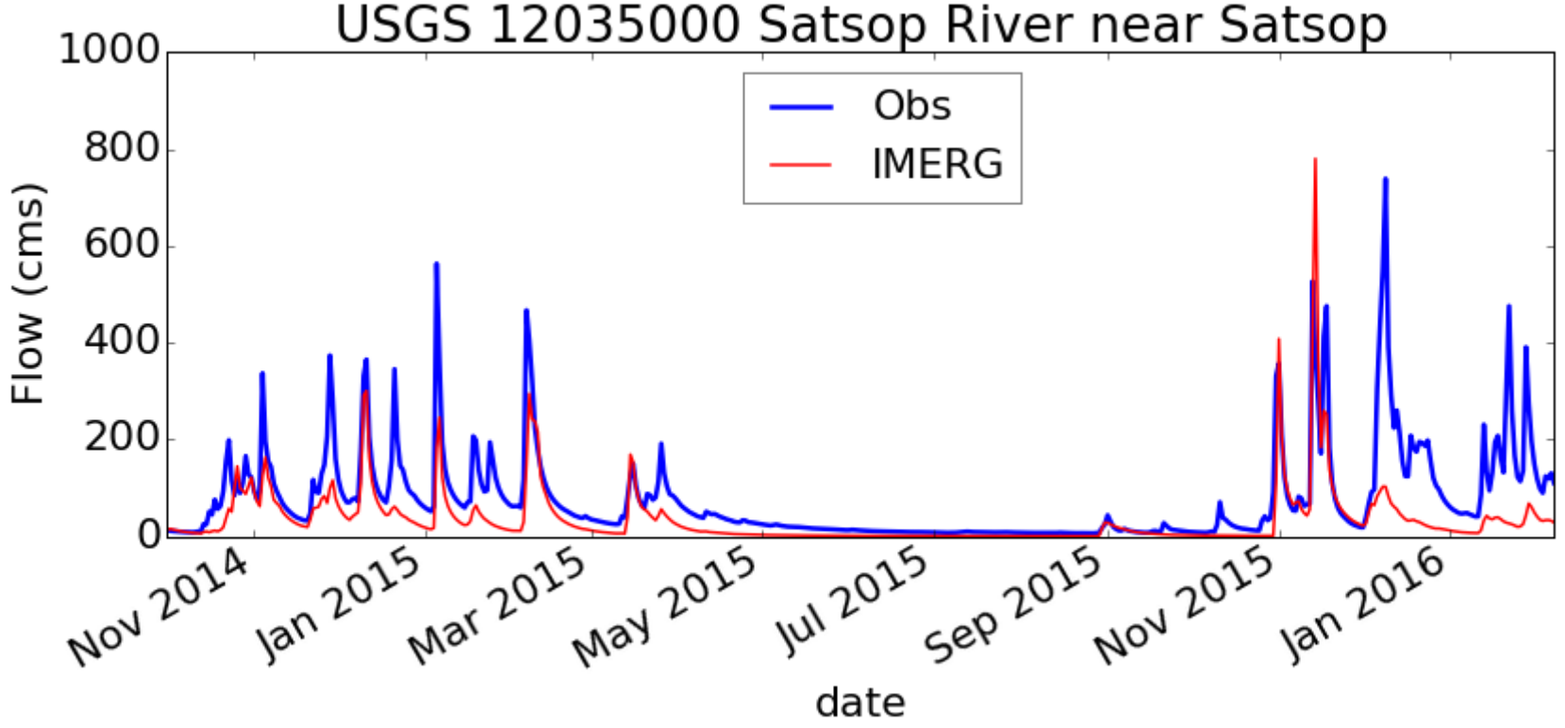

Average Absolute Relative Error of Largest 1% Streamflow Simulation

Precipitation Products	**USGS Gauge**	
	12027500	**12035000**
UW/UCLA Gridded Station	28.4%	10.1%
UW WRF	28.7%	36.8%
NSSL MRMS MM	37.9%	19.2%
IMERG	26.6%	65.6%

Next Steps

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- Incorporating observations from dual platform gauge network into precipitation and streamflow comparisons

- Understanding biases in observations in different parts of the Chehalis (higher elevation sites, etc)

Questions?